WHAT IS CLAIMED IS:

1. A method of reducing the rate of hematopoietic cell multiplication, comprising administering an effective amount of a CXCR4 agonist to the hematopoietic cells.

2. The method of claim 1 wherein the hematopoietic cells are selected from the group consisting of hematopoietic stem cells and hematopoietic progenitor cells.

3. The method of claim 1, wherein the cells are *in vivo* in a patient and a therapeutically effective amount of the CXCR4 agonist is adminstered to the patient in need of such treatment.

4. The method of claim 3, wherein the patient has a cancer.

5 The method of claim 3, wherein the patient requires autologous or allogeneic bone marrow or peripheral blood stem cell transplantation.

6. The method of claim 3, further comprising treating the patient with a cytotoxic agent, wherein the effective amount of the CXCR4 agonist is sufficient to reduce the susceptibility of the cells to the cytotoxic agent.

7. The method of claim 1, wherein the CXCR4 agonist comprises a peptide.

8. The method of claim 7, wherein the peptide is selected from the group consisting of peptides having sequence of:

KPVSLSYRCPCRFFESHVARANVKHLKILNTPNCALQIVARLK

NNNRQVCIDPKLKWIQEYLEKALN (SEQ ID NO:1); KPVSLSYRCPCRFFESH (SEQ ID NO:4); KPVSLSYRC (SEQ ID NO:6); (SEQ ID NO:8) KPVSLSYRC-X-CRYSLSVPK (SEQ ID NO:~~98~~98); KPVSLSYR (SEQ ID NO:~~119~~119); (SEQ ID NO:~~109~~109) KPVSLSYR-X-RYSLSVPK (SEQ ID NO:~~119~~119); KPVSLSYRCPCRFFGGGGLKWIQEYLEKALN (SEQ ID NO:~~13~~11); CCFSYTSRQIPQNFIADYFETSSQCSKPGVIFLTKRSRQV (SEQ ID NO:~~33~~30); KPVSLSYRCPCRFFGGGGSKPGVIFLTKRSRQV (SEQ ID NO:~~34~~31).

9. The method of claim 1, wherein the CXCR4 agonist is a peptide comprising:

a) an N-terminal sequence homologous to an SDF-1 N-terminal sequence;

b) a C-terminal sequence homologous to an SDF-1 C-terminal sequence or to a MIP-1α sequence;

c) a peptide spacer sequence linking the N-terminal sequence to the C-terminal sequence, wherein the peptide spacer sequence linking the N-terminal sequence to the C-terminal comprises naturally-occurring amino acids, non-naturally-occurring amino acids, or both naturally-occurring amino acids and non-naturally-occurring amino acids.

10. The method of claim 9, wherein the CXCR4 agonist comprises:

a) an internal cyclic amide bridge formed between a carboxylic acid side chain on a first amino acid residue and an amine side chain on a second amino acid residue.

11. The method of claim 9, wherein the CXCR4 agonist comprises:

a) an internal cyclic disulphide or lactam bond between two amino acids.

12. The method of claim 10, wherein the CXCR4 agonist, wherein the internal cyclic amide bridge is in the C-terminal sequence.

13. The method of claim 7 wherein the peptide is selected from the group consisting of polypeptides having the sequence of:

a) KPVSL SYRCP CRFFE SHVAR ANVKH LKILN TPACA LQIVA RLKNN NRQVC IDPKL KWIQE YLEKA LN (SEQ ID NO:1);

b) MNAKV VVVLV LVLTA LCLSD GKPVS LSYRC PCRFF ESHVA RANVK HLKIL NTPNC ALQIV ARLKN NNRQV CIDPK LKWIQ EYLEK ALNKR FKM (SEQ ID NO:2); or,

c) MNAKV VVVLV LVLTA LCLSD GKPVS LSYRC PCRFF ESHVA RANVK HLKIL NTPNC ALQIV ARLKN NNRQV CIDPK LKWIQ EYLEK ALNKR FKM (SEQ ID NO:3).

14. The method of claim 7, wherein the peptide is encoded by a nucleic acid that hybridizes under stringent conditions to a portion of a nucleic acid encoding SDF-1alpha, SDF-1beta or SDF-1 precursor.

15. The method of claim 1, wherein the CXCR4 agonist is SDF-1.

16. The method of claim 1, wherein the CXCR4 agonist is a peptide encoded by a nucleic acid, and the nucleic acid is used to transform the hematopietic cells so that the cells are capable of expressing the peptide.

17. A method of reducing the susceptibility of hematopoietic cells to a cytotoxic agent, comprising administering an effective amount of a CXCR4 agonist to the hematopoietic cells prior to or during exposure of the cells to the cytotoxic agent.

18. The method of claim 17 wherein the hematopoietic cells are selected from the group consisting of hematopoietic stem cells and hematopoietic progenitor cells.

19. The method of claim 17, wherein the cells are *in vivo* in a patient and a therapeutically effective amount of the CXCR4 agonist is adminstered to the patient in need of such treatment.

20. The method of claim 19, wherein the patient has a cancer.

21. The method of claim 19, wherein the patient requires autologous or allogeneic bone marrow or peripheral blood stem cell transplantation.

22. The method of claim 19 wherein the patient has an autoimmune disease.

23. A CXCR4 agonist peptide comprising:

a) an N-terminal sequence homologous to an SDF-1 N-terminal sequence;

b) a C-terminal sequence homologous to an SDF-1 C-terminal sequence or to a MIP-1α sequence;

c) a peptide spacer sequence linking the N-terminal sequence to the C-terminal sequence, wherein the peptide spacer sequence linking the N-terminal sequence to the C-terminal comprises naturally-occurring amino acids, non-naturally-occurring amino acids, or both naturally-occurring amino acids and non-naturally-occurring amino acids.

24. The CXCR4 agonist of claim 23, further comprising:

a) an internal cyclic amide bridge formed between a carboxylic acid side chain on a first amino acid residue and an amine side chain on a second amino acid residue.

25. The CXCR4 agonist of claim 23, further comprising:

a) an internal cyclic disulphide or lactam bond between two amino acids.

26. The CXCR4 agonist of claim 24, wherein the internal cyclic amide bridge is in the C-terminal sequence.